Visual expertise development; the case of medical diagnosis

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Overview

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In many professional domains, such as air traffic control (Van Meeuwen et al., 2011), fine arts (Vogt & Magnusen, 2007), car driving (Huestegge, et al., 2010), marine zoology (Jarodzka et al., 2010), and many more, expertise requires the ability to examine complex, information-dense, visual material. This is in particular true for the medical domain (e.g., fMRI, echoscopy). Such visual material poses peculiar challenges to the perceptual and cognitive system. In particular, inexperienced individuals face difficulties, as they rather attend to visually salient, instead of thematically relevant information (Jarodzka et al., 2010; Landsdale et al., 2010). To that point, little is known on how that perceptual system develops and adapts with growing expertise in medicine, let alone that we know how the learning process can be accelerated or otherwise improved. The most convenient way to study this perceptual system directly is by means of eye tracking, which is a method to measure the movements of the eyes and relate them to a stimulus to infer to which information a person attended to, for how long and in which order (Holmqvist et al., 2011). Research that has been conducted on expertise differences in viewing medical images (for an overview see Krupinski, 2010), investigated only simplicistic medical images (mainly grayscale X-ray stills of the chest) with few participants. Hence, even though these studies provide first insights into some aspects of visual expertise, they hardly capture the full complexity of the different medical professions.

In this symposium, three studies took up the challenge to investigate visual expertise as it is required in nowadays medical practice by making use of high-end eye tracking equipment to capture perceptual processes and their development in detail. The first study, investigated digital microscopy, which is a state-of-the-art imaging technique that allows the physician to interactively navigate through tissue. Furthermore, this study tackles the missing link between research on cognitive aspects of medical expertise (Schmidt & Boshuizen, 1993) and its visual aspects (Krupinski, 2010) by recording both processes and analyzing them combined. The second study also focused on state-of-the-art imaging techniques, namely positron emission tomography (PET). In this domain, the authors compared four different expertise levels and showed that visual expertise develops on this medical domain not linearly, but rather in a U-shape manner. On top of that, this study compares findings from PET with a more traditional domain within eye tracking research, namely radiology. The third study again investigates novel medical imaging techniques, namely videos of CT scans. In that, this study also tackles a hot-topic in eye movement research, namely the perception of dynamic scenes and how this can be analyzed (cf. Holmqvist et al., 2011). Moreover, this study examines in what speed this new imaging technique should be presented to enable medical experts to unfold their exceptional performance.

All studies will be discussed in the light of theories on cognitive structures underlying medical expertise development (Schmidt & Boshuizen, 1993) and how these can be extended to their visual counterparts.

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